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Bill Lewis, Director of Public Works
City of Live Oak
9955 Live Oak Boulevard
Live Oak, CA 95959

RE: NPDES Hardness Comments

Dear Mr. Lewis:

Please accept this comment to the City of Live Oak tentative order pertaining to the proper hardness recommended for use when calculating the "Effluent Concentration Allowance" (ECA) associated with copper and chronic cadmium. The tentative order (TO) recommended use of the upstream hardness value because the receiving water was observed to contain these contaminants at concentrations that occasionally exceed water quality objectives. I am writing to ask that the approach described in the tentative order be reconsidered because (1) use of upstream hardness is not universally protective when applying a consistent regulatory approach across all hardness dependent metals, and (2) the site-specific application to Live Oak results in excessively stringent regulation beyond what is needed to prevent the effluent from causing or contributing to in-stream toxicity. Based on work I have published previously (Emerick *et. al.*, 2006), the downstream hardness after the mix of effluent and receiving water is most representative of water quality conditions post discharge and every possible dilution ratio between effluent and receiving water should be assessed when determining a protective ECA. For copper and acute cadmium, use of the effluent hardness in the regulatory equations describes the most limiting condition without being arbitrarily restrictive. Detailed rationale is provided below.

Metals with hardness-based criteria include cadmium, copper, chromium III, lead, nickel, silver, and zinc. In the discussion of hardness selection in the Fact Sheet, the curve method for hardness selection is described whereby the analysis accounts for all possible dilution conditions that will be present upon discharge. The curve method compares how metals and hardness in the effluent and upstream receiving water mix and compares concentrations to water quality criteria. Criteria for chronic cadmium, chromium III, copper, nickel, and zinc have concave down shaped curves when plotted as a function of hardness. Acute cadmium, lead, and silver have concave up shaped curves when plotted as a function of hardness. Although different equations are presented for deriving a protective effluent concentration allowance for concave upward or downward criteria, the equations result from a singular and consistent application of CTR and the SIP.

Fundamental to Emerick *et al* (2006) is the need to evaluate all possible discharge conditions, including high to low receiving water flows, and the resulting change in hardness that results due to the discharge. Emerick *et al* (2006) did present the assumption that upstream metals concentrations were equal to the CTR criterion calculated when making use of the upstream hardness. At issue with the Live Oak TO is that upstream ambient copper and cadmium

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concentrations have been recorded exceeding the CTR criterion calculated from the paired upstream ambient hardness. The TO states that because the upstream ambient metals concentrations exceed the CTR criterion, the Emerick *et al* (2006) assumptions are violated, thus, negating the use of the curves method. This interpretation should be reconsidered.

The assumption that the upstream water contains metals at water quality objective is not a defining limitation of the mathematical approach described by Emerick *et al* (2006). The assumption was made only to simplify its presentation. The mathematical derivation of the equations were complex, and it was important that the reader not independently come to the wrongful conclusion that assimilative capacity was being transferred from one water to another via mixing. Therefore, by making the assumption upfront that there was no assimilative capacity present in either water prior to mixing, the illustration that assimilative capacity was produced by mixing two different waters with concave downward criteria could not be wrongly attributed to simply making use of assimilative capacity that was already present because such assimilative capacity never existed to exploit (by definition). More importantly, it was concluded that when concave upward metals were at issue, more stringent limitations than described by CTR using either effluent or receiving water hardness might be required to prevent downstream conditions of toxicity.

The draft TO correctly reported that upstream water prior to the discharge occasionally contains elevated copper and cadmium concentrations that exceed their respective water quality objectives. The occurrence of elevated upstream concentrations does not affect the effluent limitation calculations because it is not the responsibility of the discharge to clean up pollution caused by others. It is the responsibility of the discharger to not cause or contribute to conditions of toxicity, and clearly the elevated concentrations upstream of the discharge are present prior to the discharge. With concave downward criteria, Emerick *et al* (2006) demonstrated that mixing two different waters will always produce some assimilative capacity (provided the effluent was compliant with its own hardness based water quality objectives), thus, it is impossible for the effluent to cause or contribute to toxicity and, in fact, can only serve to reduce toxicity.

Most importantly, however, is that Regional Board staff correctly identified that the same assumption of simply using upstream hardness when upstream water quality objectives were violated was not protective when applied to the concave upward metals (e.g., acute cadmium). It is important that a singular and repeatable approach be implemented throughout the analysis, or confusion and improper application when applied at other situations could result. As stated above, the CTR and SIP remain applicable throughout the procedure described by Emerick *et al* (2006), and neither the CTR nor the SIP differentiates between concave downward or upward metals. Thus, a single approach must be applicable for both types of metals to assure that water quality is safeguarded. Emerick *et al* (2006) reported the equations that are best suited to calculating protective effluent concentration allowances under all possible dilution conditions.

Any decision to make use of a regulatory methodology differing from that described by Emerick *et al* (2006) is a decision to arbitrarily regulate the effluent in a seemingly more stringent manner than is described by either CTR or SIP. It would appear that antidegradation concerns are not the basis for the increased regulation because as long as the effluent is compliant with its own water quality objectives the discharge can only serve to decrease down-stream toxicity. Had the same methodology proposed for regulating copper and chronic cadmium been similarly applied to the concave upward metals, it is possible in some situations that toxicity would result.

The Report of Waste discharge correctly assessed all dilution conditions for both concave upward and downward metals and presented effluent concentration allowances that would assure that the discharge not cause or contribute to toxicity after mixing. Calculations were provided for both concave upward and downward metals. For copper, a protective effluent concentration allowance was calculated at 17 μg/L. The maximum observed effluent concentration was reported at 9.1 μg/L. For cadmium, a protective effluent concentration allowance was calculated at 4.2 μg/L. The effluent never contained detected cadmium. Thus, for both metals, the discharge not only does not cause or contribute to toxicity but will significantly reduce the toxicity that is already present. Regulating either of these metals in a manner differing from that described by Emerick *et al* (2006) is arbitrary and risks confusing the reader on the appropriate application of the Emerick *et al* (2006) study results.

In conclusion, it is my recommendation that a single and unified regulatory approach be utilized that follows CTR and the SIP and is applicable to all metals. The equations described by Emerick *et al* (2006) best describe the most universally applicable regulatory approach and accounts for all possible dilution conditions. Any deviation from the overall approach risks confusing the public and setting poor precedent for other discharge conditions.

Please feel free to call me if a more detailed presentation would be beneficial.

Sincerely,

ECO:LOGIC Engineering

Robert W. Emerick

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Principal

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